PHYSICS

PREAMBLE

The syllabus is evolved from the Senior Secondary School teaching syllabus and is intended to indicate the scope of the course for Physics examination.

It is structured with the conceptual approach. The broad concepts of matter, position, motion and time; energy; waves; fields; Atomic and Nuclear Physics, electronics are considered and each concept forms a part on which other sub-concepts are further based.

AIMS

The aims of the syllabus are to enable candidates

(1) acquire proper understanding of the basic principles and applications of Physics;

(2) develop scientific skills and attitudes as pre-requisites for further scientific activities;

(3) recognize the usefulness, and limitations of scientific method to appreciate its applicability ion other disciplines and in every life;

(4) develop abilities, attitudes and skills that encourage efficient and safe practice;

(5) develop scientific attitudes such as accuracy, precision, objectivity, integrity, initiative and inventiveness.

ASSESSMENT OBJECTIVES

The following activities appropriate to Physics will be tested:

- Acquisition of knowledge and understanding:

  Candidates should be able to demonstrate knowledge and understanding of

- Scientific phenomena, facts laws, definitions, concepts and theories;

- Scientific vocabulary, terminology and conventions (including symbols, quantities and units);

- The use of scientific apparatus, including techniques of operation and aspects of safety;
- Scientific quantities and their determinations;
- Scientific and technological applications with their social economic and environmental implications.
- Information Handling and Problem-solving

Candidates should be able, using visual, oral, aural and written (including symbolic, diagrammatic, graphical and numerical) information to

- locate select, organize and present information from a variety of sources including everyday experience;
- analyse and evaluate information and other data;
- use information to identify patterns, report trends and draw inferences;
- present reasonable explanations for natural occurrences, patterns and relationships;
- make predictions from data.
- Experimental and Problem-Solving Techniques

Candidates should be able to

- follow instructions;
- carry out experimental procedures using apparatus;
- make and record observations, measurements and estimates with due regard to precision, accuracy and units;
- interpret, evaluate and report on observations and experimental data;
- identify problems, plan and carry out investigations, including the selection of techniques, apparatus, measuring devices and materials;

- evaluate methods and suggest possible improvements;

- state and explain the necessary precautions taken in experiments to obtain

  accurate results.

SCHEME OF EXAMINATION

There will be **three** papers, Papers 1, 2 and 3, all of which must be taken. Papers 1 and 2 will be a composite paper to be taken at one sitting.

PAPER 1: Will consist of fifty multiple choice questions lasting 1¼ hours and carrying 50 marks.
PAPER 2: Will consist of two sections, Sections A and B lasting1½ hours and carrying 60 marks.
Section A - Will comprise seven short-structured questions. Candidates will be required to answer any five questions for a total of 15 marks.
Section B - Will comprise five essay questions out of which candidates will be required to answer any three for 45 marks.
PAPER 3: Will be a practical test for school candidates or an alternative to practical work paper for private candidates. Each version of the paper will comprise three questions out of which candidates will be required to answer any two in 2¾ hours for 50 marks.

DETAILED SYLLABUS

It is important that candidates are involved in practical activities in covering this syllabus. Candidates will be expected to answer questions on the topics set in the column headed ' TOPIC'. The 'NOTES' are intended to indicate the scope of the questions which will be set but they are not to be considered as an exhaustive list of limitations and illustrations.

NOTE: Questions will be set in S.I. units. However, multiples or sub-multiples of the units may be used.

PART 1
INTERACTION OF MATTER, SPACE & TIME

TOPICS	NOTES
1. Concepts of matter	
2. Fundamental and derived quantities and units	
(a) Fundamental quantities and units	Simple structure of matter should be discussed. Three physics states of matter, namely solid, liquid and gas should be treated. Evidence of the particle nature of matter e.g. Brownian motion experiment, Kinetic theory of matter. Use of the theory to explain; states of matter (solid, liquid and gas), pressure in a gas, evaporation and boiling; cohesion, adhesion, capillarity. Crystalline and amorphous substances to be compared (Arrangement of atoms in crystalline structure to be described e.g. face centred, body centred.
(b) Derived quantities and units	Length, mass, time, electric current luminous intensity, thermodynamic temperature, amount of substance as examples of fundamental quantities and m, kg, s, A, cd, K and mol as their respective units. Volume, density and speed as derived quantities and m^3, kgm^{-3} and ms^{-1} as their respective units.
3. Position, distance and displacement.	Position of objects in space using the X,Y,Z axes should be mentioned.
(a) Concept of position as a location of point- rectangular coordinates.	Use of string, metre rule, vernier calipers and micrometer screw gauge. Degree of accuracy should be noted. Metre (m) as unit of distance. Use of compass and a protractor. Graphical location and directions by axes to be stressed.
(b) Measurement of distance	

(c) Concept of direction as a way of locating a point – bearing (d) Distinction between distance and displacement.	

TOPICS	NOTES
4. Mass and weight Distinction between mass and weight	
5. Time (a) Concept of time as interval between physical events	
(b) Measurement of time	Use of lever balance and chemical/beam balance to measure mass and spring balance to measure weight. Mention should be made of electronic/digital balance. Kilogram (kg) as unit of mass and newton (N) as unit of weight.
6. Fluid at rest	The use of heart-beat, sand-clock, ticker-timer, pendulum and stopwatch/clock.
• Volume, density and relative density	Second(s) as unit of time. Experimental determination for solids and liquids.

• Pressure in fluids	Concept and definition of pressure. Pascal's principle, application of principle to hydraulic press and car brakes. Dependence of pressure on the depth of a point below a liquid surface. Atmospheric pressure. Simple barometer, manometer, siphon, syringe and pump. Determination of the relative density of liquids with U-tube and Hare's apparatus. Identification of the forces acting on a body partially or completely immersed in a fluid. Use of the principle to determine the relative densities of solids and liquids. Establishing the conditions for a body to float in a fluid. Applications in hydrometer, balloons, boats, ships, submarines etc.
• Equilibrium of bodies (i) Archimedes' principle (ii) Law of flotation	

TOPICS	NOTES
7. Motion • Types of motion: Random, rectilinear, translational, Rotational, circular, orbital, spin, Oscillatory. • Relative motion	

	Only qualitative treatment is required. Illustration should be given for the various types of motion.
• Cause of motion	Numerical problems on co-linear motion may be set. Force as cause of motion.
• Types of force: (i) Contact force (ii) Non-contact force(field force)	Push and pull These are field forces namely; electric and magnetic attractions and repulsions; gravitational pull.
• Solid friction	Frictional force between two stationary bodies (static) and between two bodies in relative motion (dynamic). Coefficients of limiting friction and their determinations. Advantages of friction e.g. in locomotion, friction belt, grindstone. Disadvantages of friction e.g reduction of efficiency, wear and tear of machines. Methods of reducing friction; e.g. use of ball bearings, rollers, streamlining and lubrication. Definition and effects. Simple explanation as extension of friction in fluids. Fluid friction and its application in lubrication should be treated qualitatively. Terminal velocity and its determination.
• Viscosity (friction in fluids)	Experiments with a string tied to a stone at one end and whirled around should be carried out to (i) demonstrate motion in a Vertical/horizontal circle.
• Simple ideas of circular motion	

TOPICS	NOTES
8. Speed and velocity	
• Concept of speed as change of distance with time	(i) show the difference between angular speed and velocity. (ii) Draw a diagram to illustrate centripetal force. Banking of roads in reducing sideways friction should be qualitatively discussed.
• Concept of velocity as change of displacement with time	
• Uniform/non-uniform speed/velocity	Metre per second (ms^{-1}) as unit of speed/velocity.
• Distance/displacement-time graph	Ticker-timer or similar devices should be used to determine speed/velocity. Definition of velocity as s t. Determination of instantaneous speed/velocity from distance/displacement-time graph and by calculation.
9. Rectilinear acceleration	
• Concept of Acceleration/deceleration as increase/decrease in velocity with time.	Unit of acceleration as ms^{-2}
• Uniform/non-uniform acceleration	Ticker timer or similar devices should be used to determine acceleration. Definition of acceleration as v t . Determination of acceleration and displacement from velocity-time

	graph
• Velocity-time graph	Use of equations to solve numerical problems.
• Equations of motion with constant acceleration; Motion under gravity as a special case.	
TOPICS	**NOTES**
10. Scalars and vectors • Concept of scalars as physical quantities with magnitude and no direction • Concept of vectors as physical quantities with both magnitude and direction.	
• Vector representation	Mass, distance, speed and time as examples of scalars.
• Addition of vectors	Weight, displacement, velocity and acceleration as examples of vectors.
• Resolution of vectors	Use of force board to determine the resultant of two forces.
• Resultant velocity using vector representation.	Obtain the resultant of two velocities analytically and graphically.

11. Equilibrium of forces ● Principle of moments ● Conditions for equilibrium of rigid bodies under the action of parallel and non-parallel forces. ● Centre of gravity and stability 12. Simple harmonic motion ● Illustration, explanation and definition of simple harmonic motion (S.H.M)	Torque/Moment of force. Simple treatment of a couple, e.g. turning of water tap, corkscrew and steering wheel.) Use of force board to determine resultant and equilibrant forces. Treatment should include resolution of forces into two perpendicular directions and composition of forces Parallelogram of forces. Triangle of forces. Should ne treated experimentally. Treatment should include stable, unstable and neutral equilibra. Use of a loaded test-tube oscillating vertically in a liquid, simple pendulum, spiral spring and bifilar suspension to demonstrate simple harmonic motion.
TOPICS	**NOTES**
● Speed and acceleration of S.H.M. ● Period, frequency and amplitude of a body executing S.H.M. ● Energy of S.H.M ● Forced vibration and	Relate linear and angular speeds, linear and angular accelerations. Experimental determination of ‘g’ with the simple pendulum and helical spring. The theory of the principles should be treated but derivation of the formula for ‘g’ is not required

resonance	Simple problems may be set on simple harmonic motion. Mathematical proof of simple harmonic motion in respect of spiral spring, bifilar suspension and loaded test-tube is not required.
13. Newton's laws of motion:	Distinction between inertia mass and weight
● First Law: Inertia of rest and inertia of motion	Use of timing devices e.g. ticker-timer to determine the acceleration of a falling body and the relationship when the accelerating force is constant.
● Second Law: Force, acceleration, momentum and impulse	Linear momentum and its conservation. Collision of elastic bodies in a straight line. Applications: recoil of a gun, jet and rocket propulsions.
● Third Law: Action and reaction	

PART II
ENERGY: Mechanical and Heat

TOPICS	NOTES
14. Energy: (a) Forms of energy	
(b) World energy resources	
(c) Conservation of energy.	
15. Work, Energy and Power	Examples of various forms of energy should be mentioned e.g. mechanical (potential and kinetic), heat chemical, electrical, light, sound, nuclear.
• Concept of work as a measure of energy transfer	Renewable (e.g. solar, wind, tides, hydro, ocean waves) and non-renewable (e.g. petroleum, coal, nuclear, biomass) sources of energy should be discussed briefly. Statement of the principle of conservation of energy and its use in explaining energy transformations.
• Concept of energy as capability to do work	Unit of energy as the joule (J)
	Unit of energy as the joule (J) while unit of electrical consumption is KWh.
• Work done in a gravitational field.	Work done in lifting a body and by falling bodies Derivation of P.E and K.E are expected to be known. Identification of types of energy possessed by a body under given conditions.
• Types of mechanical energy	
	Verification of the principle

(i) Potential energy (P.E.) (ii) Kinetic energy (K.E) ● Conservation of mechanical energy.	verification of the principle.

TOPICS	NOTES
● Concept of power as time rate of doing work.	
● Application of mechanical energy- machines. Levers, pulleys, inclined plane, wedge, screw, wheel and axle, gears.	Unit of power as the watt (W) The force ratio (F.R), mechanical advantage (M.A), velocity ratio (V.R) and efficiency of each machine should be treated. Identification of simple machines that make up a given complicated machine e.g. bicycle. Effects of friction on Machines. Reduction of friction in machines.
16. Heat Energy ● Temperature	

and its measurement	Concept of temperature as degree of hotness or coldness of a body. Construction and graduation of a simple thermometer. Properties of thermometric liquids. The following thermometer, should be treated: Constant – volume gas thermometer, resistance thermometer, thermocouple, liquid-in-glass thermometer including maximum and minimum thermometer and clinical thermometer, pyrometer should be mentioned. Celsius and Absolute scales of temperature. Kelvin and degree Celsius as units of temperature. Use of the Kinetic theory to explain effects of heat. Mention should be made of the following effects: Change of colour Thermionic emission Change in chemical properties
• Effects of heat on matter e.g (i) Rise in temperature (ii) Change of phase state (iii) Expansion (iv) Change of resistance	Qualitative and quantitative treatment Consequences and application of expansions. Expansion in buildings and bridges, bimetallic strips, thermostat, over-head cables causing sagging nd in railway lines causing buckling. Real and apparent expansion of liquids. Anomalous expansion of water.
• Thermal expansion – Linear, area and volume expansivities	

TOPICS	NOTES
• Heat transfer – Condition, convention and radiation.	
• The gas laws-Boyle's law Charles' law, pressure law and general gas law	Per Kelvin (K^{-1}) as the unit of expansivity. Use of the kinetic theory to explain the modes of heat transfer. Simple experimental illustrations. Treatment should include the explanation of land and sea breezes, ventilation and application s in cooling devices. The vacuum flask. The laws should be verified using simple apparatus. Use of the kinetic theory to explain the laws. Simple problems may be set. Mention should be made of the operation of safety air bags in vehicles.
• Measurement of heat energy: (i) Concept of heat capacity (ii) Specific heat capacity.	Use of the method of mixtures and the electrical method to determine the specific heat capacities of solids and liquids. Land and sea breezes related to the specific heat capacity of water and land, Jkg^{-1} K^{-1} as unit of specific heat capacity. Explanation and types of latent heat. Determination of the melting point of solid and the boiling point of a liquid. Effects of impurities and pressure on melting and boiling points. Application in pressure cooker.
• Latent heat	Use of the method of mixtures and the electrical method to determine the specific latent heats of fusion of ice and of vaporization of steam. Applications in refrigerators and air conditioners. Jkg^{-1} as unit of specific latent heat

(i) Concept of latent heat (ii) Melting point and boiling Point (iii) Specific latent heat of fusion and of vaporization	

TOPICS	NOTES
• Evaporation and boiling	
• Vapour and vapour pressure	Effect of temperature, humidity, surface area and draught on evaporation to be discussed. Explanation of vapour and vapour pressure. Demonstration of vapour pressure using simple experiments. Saturated vapour pressure and its relation to boiling.
• Humidity, relative humidity and dew point	Measurement of dew point and relative humidity. Estimation of humidity of the atmosphere using wet and dry-bulb hygrometer. Formation of dew, fog and rain.
• Humidity and the weather	

PART III

WAVES

TOPICS	NOTES
17. Production and propagation of waves	
• Production and propagation of mechanical waves	
• Pulsating system:	
Energy transmitted with definite speed, frequency and wavelength.	Use of ropes and springs (slinky) to generate mechanical waves
• Waveform	Use of ripple tank to show water waves and to demonstrate energy propagation by waves. Hertz(Hz) as unit of frequency. Description and graphical representation. Amplitude, wave length, frequency and period. Sound and light as wave phenomena.
• Mathematical relationship connecting frequency (f), wavelength(λ), period (T) and velocity (v)	V= fλ and T = simple problems may be set.
18. Types of waves	
• Transverse and longitudinal	Examples to be given Equation y = A sin (wt) to be explained Questions on phase difference will not be set.
• Mathematical representation of wave motion.	Ripple tank should be extensively used to demonstrate these properties with plane and circular waves. Explanation of the properties.
19. Properties of waves: Reflection, refraction, diffraction, Interference, superposition of progressive waves producing standing stationary waves	Natural and artificial. Luminous and non-luminous bodies.

20. Light waves • Sources of light	

TOPICS	NOTES
• Rectilinear propagation of light	
• Reflection of light at plane surface: plane mirror	Formation of shadows and eclipse. Pinhole camera. Simple numerical problems may be set.
• Reflection of light at curved surfaces: concave and convex mirrors	Regular and irregular reflections. Verification of laws of reflection. Formation of images. Inclined plane mirrors. Rotation of mirrors. Applications in periscope, sextant and kaleidoscope. Laws of reflection. Formation of images. Characteristics of images. Use of mirror formulae: = and magnification m = to solve numerical problems. (Derivation of formulae is not required) Experimental determination of the focal length of concave mirror. Applications in searchlight, parabolic and driving mirrors, car headlamps etc.
• Refraction of light at plane surfaces: rectangular glass prism (block) and triangular prism.	Laws of refraction. Formation of images, real and Apparent depths. Critical angle and total internal reflection. Lateral displacement and angle of deviation. Use of minimum deviation equation: $= \dfrac{\text{Sin}\ (A + D_m)/2}{\text{Sin}\ A/2}$ (Derivation of the formula is not required) Applications: periscope, prism binoculars, optical fibres. The mirage.
•	Formation of images. Use of lens formulae = and magnification tp solve numerical problems.

• Refraction of light at curved surfaces: Converging and diverging lenses	

TOPICS	NOTES
• Application of lenses in optical instruments.	
• Dispersion of white light by a triangular glass prism.	(derivation of the formulae not required). Experimental determination of the focal length of converging lens. Power of lens in dioptres (D)
21. Electromagnetic waves: Types of radiation in electromagnetic Spectrum	Simple camera, the human eye, film projector, simple and compound microscopes, terrestrial and astronomical telescopes. Angular magnification. Prism binoculars. The structure and function of the camera and the human eye should be compared. Defects of the human eye and their corrections. Production of pure spectrum of a white light. Recombination of the components of the spectrum. Colours of objects. Mixing coloured lights. Elementary description and uses of various types of radiation: Radio, infrared, visible light, ultra-violet, X-rays, gamma rays.

22. Sound Waves • Sources of sound • Transmission of sound waves • Speed of sound in solid, liquid and air • Echoes and reverberation • Noise and music • Characteristics of sound	Experiment to show that a material medium is required. To be compared. Dependence of velocity of sound on temperature and pressure to be considered. Use of echoes in mineral exploration, and determination of ocean depth. Thunder and multiple reflections in a large room as examples of reverberation. Pitch, loudness and quality.

TOPICS	NOTES
• Vibration in strings	
• Forced vibration	The use of sonometer to demonstrate the dependence of frequency (f) on length (1), tension (T) and mass per unit length (liner density) (m) of string should be treated. Use of the formula: o = In solving simple numerical problems. Applications in stringed instruments: e.g. guitar, piano, harp and violin.
(i) Resonance (ii) Harmonies and overtones	Use of resonance boxes and sonometer to illustrate forced vibration. Use of overtones to explain the quality of a musical note. Applications in percussion instruments: e.g drum, bell, cymbals, xylophone. Measurement of velocity of sound in air or frequency of tuning fork using the resonance tube. Use of the relationship $v = \lambda$ in solving numerical problems. End correction is expected to be mentioned. Applications in wind instruments e.g. organ, flute, trumpet, horn, clarinet and saxophone.
• Vibration of air in pipe – open and closed pipes	

PART IV
FIELDS

TOPICS	NOTES
23. Description property of fields.	
• Concept of fields: Gravitational, electric and Magnetic	
• Properties of a force field	
24. Gravitational field	
• Acceleration due to gravity, (g)	Use of compass needle and iron filings to show magnetic field lines.
• Gravitational force between two masses:	G as gravitational field intensity should be mentioned, g = F/m. Masses include protons, electrons and planets
Newton's law of gravitation	Universal gravitational constant (G) Relationship between 'G' and 'g'
• Gravitational potential and escape velocity.	Calculation of the escape velocity of a rocket from the earth's gravitational field.
25. Electric Field	Production by friction, induction and contact.
• Electrostatics	A simple electroscope should be used to detect and compare charges on differently-shaped bodies.
• Production of electric charges	Application in light conductors. Determination, properties and field patterns of charges.
• Types of distribution of	

charges • Storage of charges • Electric lines of force	

TOPICS	NOTES
• Electric force between point charges: Coulomb's law	
• Concepts of electric field, electric field intensity (potential gradient) and electric potential.	Permittivity of a medium.
• Capacitance- Definition, arrangement and application	Calculation of electric field intensity and electric potential of simple systems. Factors affecting the capacitance of a parallel-plate capacitor. The farad (F) as unit of capacitance. Capacitors in series and in parallel. Energy stored in a charged capacitor. Uses of capacitors: e.g. in radio and Television. (Derivation of formulae for capacitance is not required)
• Current electricity • Production of electric current from primary and secondary cells	Simple cell and its defects. Daniel cell, Lechanché cell (wet and dry). Lead-acid accumulator. Alkalne-cadium cell. E.m.f. of a cell, the volt (V) as unit of e.m.f. Ohm's law and resistance. Verification of Ohm's law. The volt (V), ampere (A) and ohm (Ω) as units of p.d., current and reisistance respectively.
• Potential difference and electric current	Series and parallel arrangement of cells and resistors. Lost volt and internal resistance of batteries.

electric current ● Electric circuit ● Electric conduction through materials ● Electric energy and power	Ohmic and non ohmic conductors. Examples of ohmic conductors are metals, non-ohmic conductors are semiconductors. Quantitative definition of electrical energy and power. Heating effect of an electric current and its application. Conversion of electrical energy to mechanical energy e.g. electric motors. Conversion of solar energy to electrical and heat energies: e.g. solar cells, solar heaters.

TOPICS	NOTES
● Shunt and multiplier ● Resistivity and Conductivity ● Measurement of electric current, potential difference, resistance, e.m.f. and internal resistance of a cell. 26. Magnetic field ● Properties of magnets and magnetic materials.	Use in conversion of a galvanometer into an ammeter and a voltmeter. Factors affecting the electrical resistance of a material should be treated. Simple problems may be set. Principle of operation and use of ammeter, voltmeter, potentiometer. The wheatstone bridge and metre bridge.

● Magnetization and demagnetization.	Practical examples such as soft iron, steel and alloys.
● Concept of magnetic field	Temporary and permanent magnets. Comparison of iron and steel as magnetic materials. Magnetic flux and magnetic flux density. Magnetic field around a permanent magnet, a current-carrying conductor and a solenoid. Plotting of line of force to locate neutral points Units of magnetic flux and magnetic flux density as weber (Wb) and tesla (T) respectively.
● Magnetic force on: (i) a current-carrying conductor placed in a magnetic field; (ii) between two parallel current-carrying conductors	Qualitative treatment only. Applications: electric motor and moving-coil galvanometer. Examples in electric bell, telephone earpiece etc. Mariner's compass. Angles of dip and declination. Solving simple problems involving the motion of a charged particle in a magnetic field, using F=qvB sin
● Use of electromagnets	Identifying the directions of current, magnetic field and force in an electromagnetic field (Fleming's left-hand rule).
● The earth's magnetic field	
● Magnetic force on a moving charged particle	
27. Electromagnetic field	
● Concept of electromagnetic field	

TOPICS	NOTES
• Shunt and multiplier	
• Resistivity and Conductivity	
• Measurement of electric current, potential difference, resistance, e.m.f. and internal resistance of a cell.	Use in conversion of a galvanometer into an ammeter and a voltmeter.
26. Magnetic field	Factors affecting the electrical resistance of a material should be treated. Simple problems may be set.
• Properties of magnets and magnetic materials.	Principle of operation and use of ammeter, voltmeter, potentiometer. The wheatstone bridge and metre bridge.
• Magnetization and demagnetization.	Practical examples such as soft iron, steel and alloys.
• Concept of magnetic field	Temporary and permanent magnets. Comparison of iron and steel as magnetic materials. Magnetic flux and magnetic flux density. Magnetic field around a permanent magnet, a current-carrying conductor and a solenoid. Plotting of line of force to locate neutral points Units of magnetic flux and magnetic flux density as weber (Wb) and tesla (T) respectively.
• Magnetic force on: (i) a current-carrying conductor placed in a magnetic field; (ii) between two parallel current-carrying	Qualitative treatment only. Applications: electric motor and moving-coil galvanometer. Examples in electric bell, telephone earpiece etc. Mariner's compass. Angles of dip and declination. Solving simple problems involving the motion of a charged particle in

conductors ● Use of electromagnets ● The earth's magnetic field ● Magnetic force on a moving charged particle	Solving simple problems involving the motion of a charged particle in a magnetic field, using F=qvB sin Identifying the directions of current, magnetic field and force in an electromagnetic field (Fleming's left-hand rule).
27. Electromagnetic field ● Concept of electromagnetic field	
TOPIC	NOTES
● Electromagnetic induction Faraday's law ,Lenz's law and motor-generator effect ● Inductance ● Eddy currents	Applications: Generator (d.c.and a.c.) induction coil and transformer. The principles underlying the production of direct and alternating currents should be treated. Equation $E = E_o \sin wt$ should be explained. Qualitative explanation of self and mutual inductance. The unit of inductance is henry (H). ($E = LI^2$)

	Application in radio,T.V., transformer. (Derivation of formula is not required).
• Power transmission and distribution	A method of reducing eddy current losses should be treated. Applications in induction furnace, speedometer, etc.
28. Simple a.c. circuits	Reduction of power losses in high-tension transmission lines. Household wiring system should be discussed.
• Graphical representation of e.m.f and current in an a.c. circult.	Graphs of equation I – Io sin wt and\E = E_o sinwt should be treated. Phase relationship between voltage and current in the circuit elements; resistor, inductor and capacitor.
• Peak and r..m.s. values	
TOPIC	
•	**NOTES**
(c) Series circuit containing resistor, inductor and capacitor	
(d) Reactance and impedance	
(e) Vector diagrams	
• Resonance in an a.c, circuit	Simple calculations involving a.c. circuit. (Derivation of formulae is not required.) X_L and X_c should be treated. Simple numerical problems may be set.
• Power in an a.c. circuit.	Applications in tuning of radio and T.V. should be discussed.

PART V
ATOMIC AND NUCELAR PHYSICS

TOPICS	NOTES
29. Structure of the atom	
• Models of the atom	Thomson, Rutherford, Bohr and electron-cloud (wave-mechanical) models should be discussed qualitatively. Limitations of each model. Quantization of angular momentum (Bohr)
• Energy quantization	Energy levels in the atom. Colour and light frequency. Treatment should include the following: Frank-Hertz experiment, Line spectra from hot bodies, absorption spectra and spectra of discharge lamps.
• Photoelectric effect	Explanation of photoelectric effect. Dual nature of light. Work function and threshold frequency. Einstein's photoelectric equation and its explanation. Application in T.V., camera, etc. Simple problems may be set.
• Thermionic emission	Explanation and applications.
• X-rays	Production of X-rays and structure of X-ray tube. Types, characteristics, properties, uses and hazards of X-rays. Safety precautions
	Protons and neutrons. Nucleon number (A), proton number (Z), neutron number (N) and the equation: A-Z + N to be treated. Nuclides and their notation. Isotopes.

30. Structure of the nucleus ● Composition of the nucleus	
TOPICS ● Radioactivity – Natural and artificial ● Nuclear reactions --- Fusion and Fission 31. Wave-particle paradox	**NOTES** Radioactive elements, radioactive emissions (,βand their properties and uses. Detection of radiations by G – M counter, photographic plates, etc. should be mentioned. Radioactive decay, half-life and decay constant. Transformation of elements. Applications of radioactivity in agriculture, medicine, industry, archaeology, etc. Distinction between fusion and fission. Binding energy, mass defect and energy equation: $E= mc^2$ Nuclear reactors. Atomic bomb. Radiation hazards and safety precautions. Peaceful uses of nuclear reactions. Simple illustration of the dual nature of light.

• Electron diffraction • Duality of matter	

HARMONISED TOPICS FOR SHORT STRUCTURED QUESTIONS FOR ALL MEMBER COUNTRIES

TOPICS	NOTES
1. Derived quantities and dimensional Analysis	Fundamental quantities and units e.g. Length, mass, time, electric current, luminous intensity e.t.c., m, kg,s, A, cd, e.t.c. as their respective units Derived quantities and units. e.g. volume, density, speed e.t.c. m^3, kgm^{-3}, ms^{-1} e.t.c. as their respective unit Explanation of dimensions in terms of fundamental and derived quantities. Uses of dimensions - to verity dimensional correctness of a given equation - to derive the relationship between quantities - to obtain derived units.
2. Projectile motion concept of projectiles as an object thrown/release into space	Applications of projectiles in warfare, sports etc. Simple problems involving range, maximum height and time of flight may be set.
3. Satellites and rockets	Meaning of a satellite comparison of natural and artificial satellites parking orbits, Geostationary satellites and period of revolution and speed of a satellite. Uses of satellites and rockets
4. Elastic Properties of solid: Hooke's law, Young's modules and work done in springs and string	Behaviour of elastic materials under stress – features of load – extension graph Simple calculations on Hook's law and Young's modulus.
	Solar energy; solar panel for heat energy supply. Explanation of a blackbody. Variation of intensity of black body radiation with wavelength at different temperatures.

springs and string Thermal conductivity: Solar energy collector and Black body Radiation. 5. Fibre Optics	Explanation of concept of fibre optics. Principle of transmission of light through an optical fibre Applications of fibre optics e.g. local area Networks (LAN) medicine, rensing devices, carrying laser beams e.t.c.
TOPICS	**NOTES**
6. Introduction to LASER	Meaning of LASER Types of LASERS (Solid state, gas, liquid and semi-conductor LASERS Application of LASERS (in Scientific research, communication, medicine military technology, Holograms e.t.c. Dangers involved in using LASERS.
7. Magnetic materials	Uses of magnets and ferromagnetic materials.
8. Electrical Conduction through materials [Electronic]	Distinction between conductors, semiconductors and insulators in term of band theory. Semi conductor materials (silicon and germanium) Meaning of intrinsic semiconductors. (Example of materials silicon and germanium). Charge carriers Doping production of p-type and n-type extrinsic semi conductors. Junction diode – forward and reverse biasing, voltage characteristics. Uses of diodes Half and full wave rectification.
	Use of kinetic theory to explain diffusion.
9. Structure of matter	Electron diffraction

10. Wave – particle paradox	Duality of matter Simple illustrations of dual nature of light.